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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/804,158	03/13/2001	Susumu Kawada	57454-037	8619

7590

01/16/2003

McDERMOTT, WILL & EMERY  
600 13th Street, N.W.  
Washington, DC 20005-3096

EXAMINER

SAGAR, KRIPA

ART UNIT

PAPER NUMBER

1756

DATE MAILED: 01/16/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary****Application No.**

09/804,158

**Applicant(s)**

KAWADA ET AL.

**Examiner**

Kripa Sagar

**Art Unit**

1756

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --****Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 13 March 2001.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-65 is/are pending in the application.
- 4a) Of the above claim(s) 8-14 and 63-65 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-7 and 15-62 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 13 March 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                  | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____  |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                         | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>5</u> . | 6) <input type="checkbox"/> Other:  |

**DETAILED ACTION**

***Election/Restrictions***

1. Applicant's election without traverse of Group I, Claims 1-7,15-62 in Paper No. 7 is acknowledged.

***Claim Rejections - 35 USC § 103***

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1-7 and 15-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Pat. 5942356 to Mitsui et al. in view of Jap.Pat. 08-127870 to Nagatani et al. and further in view of US Pat. 5938897 to Isao et al. and further in view of US Pat. 5322605 to Yamanishi.

The invention discloses a method of depositing a phase shifting film on a mask substrate, using a long throw sputter-coating unit.

The claims recite the use of a long throw sputtering unit to coat a transparent substrate with a metal-silicide-oxy-nitride film. The sputtering conditions are specified.

Mitsui teaches a method of depositing a MoSiON phase shifting film using physical vapor deposition. The MoSi target is sputtered with an inert Ar gas and reactive NO<sub>2</sub> gas is mixed to form the desired layer of phase shifting film. Mitsui teaches forming a phase shifting mask blank by uniform deposition of the film on a transparent substrate (8;30-40).

Mitsui does not teach long-throw sputtering unit. The sputtering conditions are tailored to the application and differ from those of the instant claims. It does not heat-treat the deposited film. The gases are mixed.

Nagatani teaches the use of a long-throw sputtering device for coating a metal nitride film. The target to source distances range from 140-200mm. Ar is the inert gas for sputtering while N<sub>2</sub> is the reactive ion for forming the film. The unit forms a stable plasma at pressures less than 0.1Pa (  $7.5 \times 10^{-4}$  Torr). The ratio of the reactive to inert gases lies between 25% and 88%. The precise composition of the gas is a process design which is based on the composition and properties of the film to be formed as illustrated by Mitsui's examples and tabulated in Figs.7-8.

Nagatani does not heat-treat the deposited film. It does not introduce the inert and reactive gases separately.

Isao teaches forming a phase-shifting photomask blank by sputtering a MoSi target with Ar mixed with NO. The film is annealed at 200deg.C. or higher.

Isao does not introduce the inert and reactive gases separately.

Yamanishi teaches a sputtering device where the discharge gas (inert gas) and the reactive gas are introduced into the chamber by separate inlets.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Nagatani's longthrow sputtering device with separate gas inlets as taught by Yamanishi, to form Mitsui's film and annealing it as taught by Isao, because Mitsui emphasizes the importance of controlling film thickness and composition (2;6-27) and Nagatani proves that the device provides a film of uniform of thickness

Art Unit: 1756

(abstract); Isao teaches that MoSiON films are stabilized with improved optical properties by heat treatment ( 3;31-35). Yamanishi teaches that the separation of the gases prevents the reaction of the reactive gas with the target; a homogeneous film can thus be formed on the substrate ( 2;42-56).

4. Claims 22-62 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mitsui in view of Nagatani and further in view of Isao and further in view of Yamanishi as applied to claim 1-7,15-21 above, and further in view of US Pat.5952128 to Isao et al. ("128 reference) and further in view of the non-patent publication of Angelopoulos.

The instant claims recite the process for making a phase shift mask with a film formed by the above technique and fabricating a semiconductor device using the mask.

The teachings Mitsui, Nagatani, Isao and Yamanishi have been discussed above. Mitsui and Isao teach the process for forming a phase shift film and for fabricating a phase shift mask blank with the film. Mitsui teaches patterning a phase shift film layer and fabricating a mask. They do not teach making a mask or the use of the mask to form devices. Nagatani teaches the use of a longthrow sputtering device for depositing a film while Yamanishi's invention is directed towards a sputtering device. They do not teach making a mask.

The steps recited in the claims for making and using the mask are conventional and are known in the art. The '128 reference teaches the steps in fabricating a mask with a phase shift film on a blank. These include forming a resist layer, depositing an anti-charging layer on the resist when using e-beam lithography, patterning the resist and

Art Unit: 1756

etching the phase shift film to form the device patterns (14;58-15;31). The device patterns are transferred to a semiconductor substrate to form the device ( 1;24-34).

The '128 reference does not explicitly teach the use of a conducting polymer or specific metal layers as anti-charging layers. These are conventional and widely used in the art. Angelopoulos teaches that thin metal films are the norm but conductive polymers may be used for charge dissipation in e-beam lithography ( p.923, sec. B).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form photomasks and use them to fabricate devices as taught by the '128 reference, with conductive polymers for patterning the mask blanks as taught by Angelopoulos because these are conventional and widely used techniques which provide successful methods of forming phase shift masks and for fabricating semiconductor devices. Angelopoulos further teaches that conductive polymers are easier to process.

### ***Conclusion***

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

The novelty of the invention is not clear. Applicant has claimed conventional materials and processes widely used in making phase shift masks.

The non-patent publication of Motegi et al. (J.Vac.Sci.Tech. B, 1995) teaches the advantages of using a longthrow sputtering device.

Jap.Pat. 11-021669 to Matsuura et al. teaches the use of separate gas inlets in a longthrow sputtering device.

US Pat. 5955223 to Mitsui teaches the fabrication of a phase shift mask with e-beam lithography (1;64-2;27). It teaches methods of forming mask blanks by sputtering metal silicides, adjusting the gas composition to obtain the desired optical and processing properties.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kripa Sagar whose telephone number is 703-605-4427. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark F Huff can be reached on 703-308-2464. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703.

-308-0661

MH/ks  
January 9, 2003

  
MARK F. HUFF  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 1700